MULTIMEDIA UNIVERSITY®

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

HHG1011 – BASIC HUMAN GENETICS

3 MARCH 2016
(2 Hours)
14:30-16:30

INSTRUCTIONS TO STUDENTS

1. This paper consists of **14** pages (including the front page) with **3** Parts (**A, B and C**).
2. **Part A** consists of **15 Multiple Choice Questions** (MCQ). All questions carry equal marks (1 mark per question). Answer **ALL** questions in the **OMR** provided on page **5** of this paper.
3. **Part B** consists of **6 Short Answer Type** questions. All questions carry equal marks (10 marks per question). **Answer 5 of the 6 questions.** Print your answers **clearly** and **neatly** in the boxes provided.
4. **Part C** consists of **2 Essay** questions. All questions carry equal marks. **Answer all QUESTIONS**. Print you answers clearly and neatly in the **answer booklet**.

PART A: Multiple Choice Questions

Questions 1 to 15 **[15 Marks]**

1. Which of the following is (are) associated with silencing of a eukaryotic gene?
   A. Deacetylation of histones
   B. Methylation of histones
   C. Phosphate group removal from histones
   D. All of the above can inactivate eukaryotic gene expression

2. Event of a fertilization include;
   I. More than one sperm enter an oocyte
   II. Outer membranes of sperm meet secondary oocyte
   III. A wave of electricity spread physical and chemical across oocyte surface
   A. I and III
   B. II and III
   C. I and II
   D. All of above

3. The following are examples of teratogen, **EXCEPT**;
   A. Cocaine
   B. Thalidomide
   C. Cigarettes
   D. Ascorbic acid

4. The following are the single gene process that are important in aging;
   I. Control on insulin secretion
   II. Immune system functioning
   III. Response to stress
   IV. Tumour suppression protein
   A. I and II
   B. I and IV
   C. I,II and III
   D. All of above

5. The following is/are basic difference(s) between spermatogenesis and oogenesis:
   I. During spermatogenesis two or more polar bodies are produced
   II. In oogenesis, one mature ovum is produced and in spermatogenesis 4 mature sperms are produced
   III. Spermatogenesis involves mitosis and meiosis but oogenesis involves meiosis only
   IV. Spermatogenesis occurs after meiosis, whereas differentiation of the female gamete may occur early in meiosis
   A. I and III
   B. II and IV
   C. I and IV
   D. All of above

Continued...

6. How does the sporadic form of retinoblastoma differ from the inherited form of retinoblastoma?
   A. Different genes are involved
   B. The sporadic form involves two somatic mutations and does not involve germline mutations
   C. The sporadic form is more difficult to treat than the inherited form
   D. Mutations are not involved in the sporadic form

7. The following are the categories of Single Gene Disorder;
   I. X-linked
   II. Autosomal recessive
   III. Autosomal dominant
   IV. Polygenic trait
   A. I and II
   B. II, III, IV
   C. I,II and III
   D. All of above

8. The following statement(s) regarding multifactorial inheritance is/are true:
   I. Most isolated neural tube defects belong to this category
   II. The recurrence risk does not depend on the previous incidence of the same condition in the family
   III. Blood groups are inherited in this manner
   IV. It is due to the effects of a large number of genes and the environment
   A. I and IV
   B. II, III, IV
   C. I,II and III
   D. All of above

9. A spontaneous mutation is more likely to occur in
   I. repeated DNA sequences
   II. high GC content DNA sequences
   III. symmetrical DNA sequences
   IV. promoter region
   A. I and II
   B. I and III
   C. II and IV
   D. All of above

10. Familial cancer is caused by:

   A. a mutation in somatic cells only.
   B. a mutation in germline cells only.
   C. a germline mutation plus a somatic mutation in affected tissue.
   D. two germline mutations

Continued...

11. Which of the following is NOT TRUE about **Canavan Disease**
A. causes brain degeneration in children
B. causes insufficient of myelin
C. causes building up of N-acetylaspartate
D. causes development of oligodendrocytes

12. Individual with multiple gene influence variability in drug response called
A. pharmacodynamics
B. pharmacogenomics
C. pharmacogenetics
D. pharmacokinetics

13. The following is/are the assumption(s) used in Hardy-Weinberg equilibrium:
I. Small population size
II. Random mating
III. No migration
IV. No natural selection
A. I and III
B. I and II
C. I, II and III
D. II, III and IV

14. Using a "car and driver" analogy, which of the following accurately describes the role of tumor-suppressor genes and proto-oncogenes in normal cells?
A. Tumor-suppressor genes are the gas pedal, while proto-oncogenes are the brakes
B. Tumor-suppressor genes are the brakes while proto-oncogenes are the gas pedal
C. Both tumor-suppressor genes and proto-oncogenes are like the gas, but tumor-suppressors are like turbo and proto-oncogenes are like a regular carburetor
D. Tumor-suppressor genes are like the steering wheel, and proto-oncogenes are like the turn signals

15. Your maternal grandfather has a genetic disorder of the mitochondrial gene cytochrome oxidase. What is your risk of inheriting the disease?
A. 100%
B. 50%
C. 25%
D. 0%

Continued...

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MULTIPLE CHOICE QUESTION ANSWER SHEET

TABLE NO:_____ STUDENT ID:_____

SUBJECT: _____ SUBJECT CODE: _____

1 (A)(B)(C)(D)	6 (A)(B)(C)(D)	11 (A)(B)(C)(D)
2 (A)(B)(C)(D)	7 (A)(B)(C)(D)	12 (A)(B)(C)(D)
3 (A)(B)(C)(D)	8 (A)(B)(C)(D)	13 (A)(B)(C)(D)
4 (A)(B)(C)(D)	9 (A)(B)(C)(D)	14 (A)(B)(C)(D)
5 (A)(B)(C)(D)	10 (A)(B)(C)(D)	15 (A)(B)(C)(D)

Continued...

PART B: Short Answer Type Questions. Answer 5 of the 6 questions

Question 1

a. Match the following: **[2.5 marks]**

i. Cancer( )	A. produces proteins that facilitate cell proliferation
ii. Proto-oncogene( )	B. uncontrolled cell division
iii. Gatekeeper gene( )	C. DNA damage repair
iv. Caretaker genes( )	D. DNA damage detector and reporter
v. ATM and ATR genes( )	E. cell death induction

b. Match the following: **[2.5 marks]**

i. Mendelian trait( )	A. refers to segregation of genes
ii. Autosomal dominant trait( )	B. can skip generations and can affect both sexes
iii. Autosomal recessive traits( )	C. does not generally skip generations and can affect both sexes
iv. Mendel's first law( )	D. refers to independent assortment of genes
v. Mendel's second law( )	E. caused by a single gene

c. Match the following: **[2.5 marks]**

i. Prenatal screen( )	A. population-wide testing for common inborn errors of metabolism
ii. New born screen( )	B. determines risk of a condition in the fetus
iii. Diagnostic test( )	C. detects allele(s) associated with illness but not absolutely diagnostic
iv. Predisposition test( )	D. identifies heterozygotes
v. Carrier screen( )	E. confirms diagnosis based on symptoms

Continued...

d. Match the following: **[2.5 marks]**

i. Oogonium( ) ii. Oocytes( ) iii. Morula( ) iv. Blastocyst( ) v. Gastrula( )	A. A hollow structure within inner and an outer cell mass. B. an immature ovum C. An early metazoan embryo in which the ectoderm, mesoderm, and endoderm are established D. Formed in large numbers by mitosis early in fetal life from primordial germ cells E. A solid ball of cells contained within the zona pellucida

Question 2

a. Both Lim and Linda have normal color vision. After 10 years of marriage, Linda gives birth to a color-blind daughter. Lim files for divorce, claiming he is not the father of the child. **[4 marks]**

i. Is Lim justified in his claim of nonpaternity? Explain your answer.

ii. If Linda had given birth to a color-blind son, would Lim be justified in claiming nonpaternity? **[2 marks]**

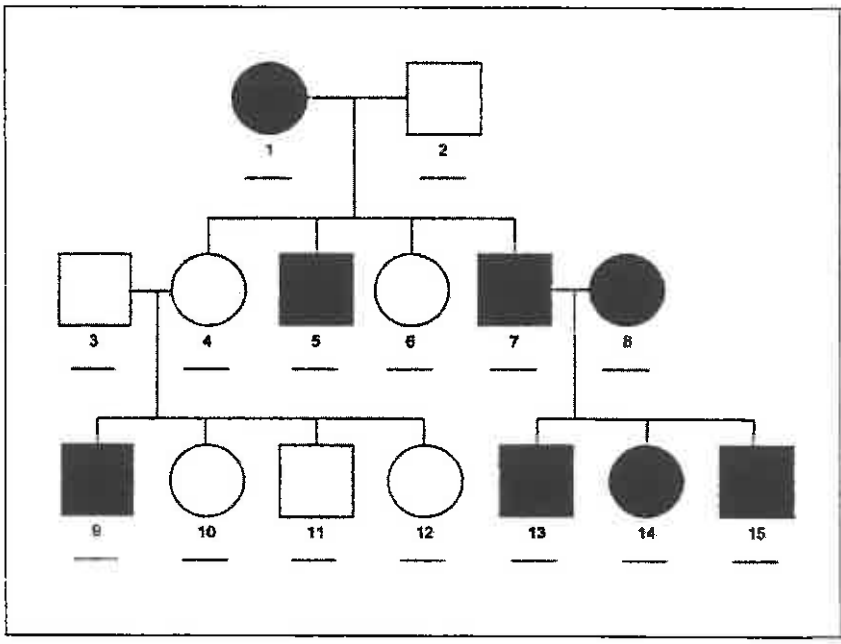
Continued...

b. Tom has XXY chromosomes (Klinefelter syndrome) and is color-blind. His mother and father have normal color vision, but his maternal grandfather is color-blind. Assume that Tom's chromosome abnormality arose from nondisjunction in meiosis. In which parent and in which meiotic division did nondisjunction occur? Explain your answer.

[4 marks]

Question 3

a. The following is a pedigree for an X-linked recessive disease. Write the genotypes of all individuals in the table. **[3.5 marks]**

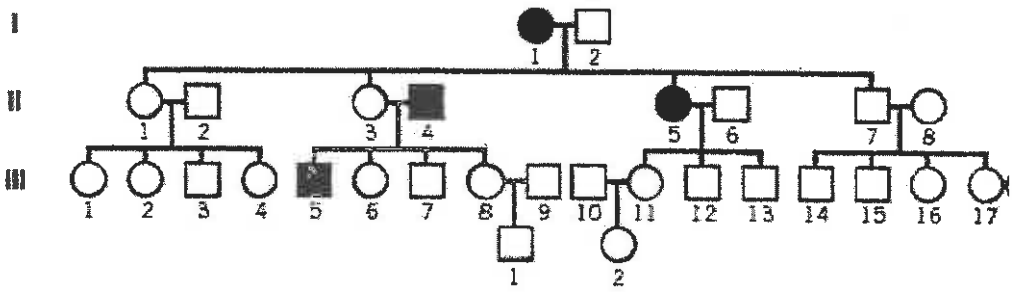


1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____

Continued...

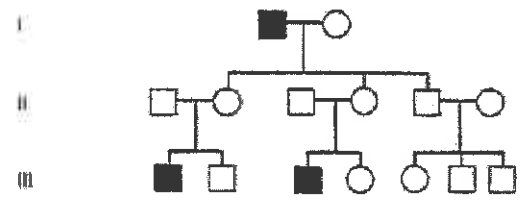
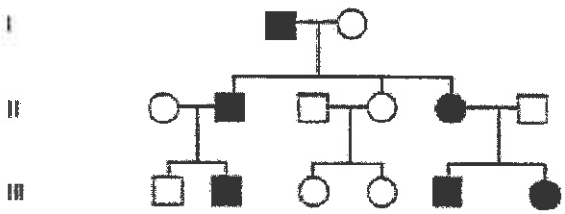
b. The pedigree below shows the inheritance of **a recessive trait**. What is the probability for III-1 and III-12 to be carriers of the trait?

[2.5 marks]



c. What pattern of inheritance is shown in the following pedigrees? No need to explain your reasoning.

[4 marks]

1. 	
2. 	

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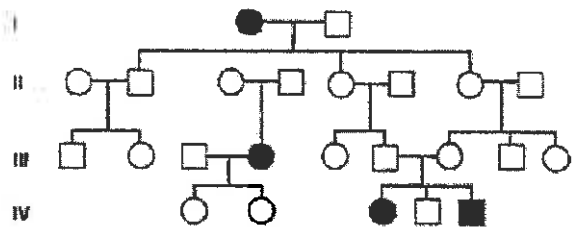
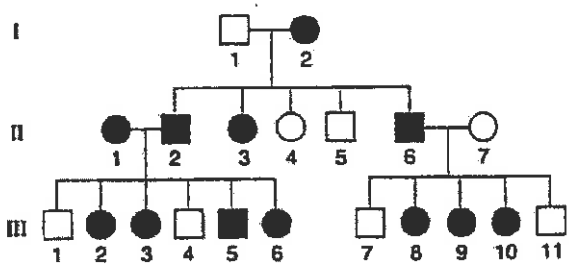
3. 	
4. 	

Question 4

a. State if the following statements are **TRUE** or **FALSE**

[5 marks]

i. The founder effect occurs when small groups of individuals leave a population to start their own	
ii. In the Hardy-Weinberg equation, 2pq refers to the proportion of heterozygotes in a population	
iii. Frequency of an X-linked recessive allele in males equals to 2pq	
iv. Migration is an example of natural selection	
v. Genetic drift causes isolated populations to be in Hardy-Weinberg equilibrium	

Continued...

b. Hemophilia is an X-linked disease that are more common in male than female. Given that the incidence of hemophilia in male was 1 in 10,000, and based on the Hardy Weinberg equation, work out the following frequency; **[5 marks]**

i. Calculate the genotype frequency of affected male

ii. Calculate the genotype frequency of affected female

iii. Calculate the genotype frequency of carrier female

Continued...

Question 5

a. What are the different approaches that can be used in gene therapy? **[3 marks]**

b. Viruses cause illness. How, then, can viruses be used as vectors in gene therapy? **[3 marks]**

c. Give TWO examples of viruses used as vector in gene therapy **[2 marks]**

d. Sally is suffered from Adenosine Deaminase Deficiency and she will go through gene therapy treatment. What are the risks she should consider for her treatment? List at least FOUR. **[2 marks]**

Continued...

Question 6

a. Why quantitative traits such as diabetic mellitus are called multifactorial trait?

[1 mark]

b. What are the different types of Diabetes? Explain the cause of each of it.

[4 marks]

c. State 2 risk factors for each type of diabetes

[2 marks]

e. How the prevention for diabetes disease type 2 can be achieved? List at least SIX.

[3 marks]

Continued...

Part C Answer all essay questions in the answer booklet.

Question 1

Each year a number of children are born with biological defects that impair normal body function. For the following conditions, discuss such aspects as the symptoms, the biological cause, and possible means of detection and/or prevention (i) Sickle cell anemia and (ii) Down syndrome.

[10 marks]

Question 2

Epigenetic is the study of changes to the chemical group that associated with DNA that affect gene expression. Discuss in detail two most common epigenetic processes in term principle and application.

[10 marks]

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